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## AUTHORITIES

This Plan is developed, promulgated, and maintained pursuant to the following state and federal statutes and regulations:

1. Code of Federal Regulations Title 44, Part 201, 205 and 206.
2. Public Law 106-390, Disaster Mitigation Act of 2000.
3. Public Law 93-288, The Disaster Relief Act of 1974, as amended by Public Law 100-707, the Robert T. Stafford Disaster Relief and Emergency Assistance Act.
3. Public Law 96-342, Improved Civil Defense 1980.
4. Public Law 99-499, Superfund Amendment and Re-authorization Act (SARA) of 1986, Title III, Emergency Planning Community Right-to-Know Act (EPCRA), Title 42, Chapter 116.
5. Public Law 920 Federal Civil Defense Act of 1950, as amended.
6. Public Law 105-19 Volunteer Protection Act of 1997.
7. Response to Hazardous Materials Incidents - Title 10, Chapter 3, Part 12 MCA.

## PREFACE

Emergency management is typically divided into four interrelated actions: mitigation, preparedness, response, and recovery. This plan will focus on the mitigation phase only, as the other three phases are outside the scope of this framework.

Mitigation actions involve lasting, often permanent, reduction of exposure to, probability of, or potential loss from hazard events. They tend to focus on where and how to build. Examples include: zoning and building code requirements for rebuilding in high-hazard areas; flood plain buy-outs; and analysis of flood plain and other hazard-related data to determine where it is safe to build in normal times, to open shelters in emergencies, or to locate temporary housing in the aftermath of a disaster. Mitigation also can involve educating businesses and the public on simple measures they can take to reduce loss and injury, like fastening bookshelves, water heaters, and file cabinets to walls to keep them from falling during earthquakes.

Cost-effective mitigation measures are the key to reducing disaster losses in the long term. In hazard-prone areas, mitigation can break the cycle of having to rebuild and rebuild again with every recurrence of floods, wildfires, or earthquakes. Where there is a willingness to mitigate, opportunities can be found. Ongoing efforts might include: educating the private sector about what it can do to mitigate at home and at work; reaching out to planning, zoning, and development agencies to ensure that hazard conditions are considered in comprehensive plans, construction permits, building codes, design approvals, etc.; and creating inventories of existing structures and their vulnerabilities, to aid mitigation planning. There is also a need for planning to take advantage of mitigation opportunities in the aftermath of an emergency or disaster, when hazard awareness is high, funds may become available (with associated requirements for mitigation), and disruption of the *status quo* makes it possible to rethink design and location of some facilities and infrastructure. **Attention to mitigation opportunities can make safer communities.**

The Madison County Pre-Disaster Mitigation Plan is a combined effort of Madison County, the Madison County Local Emergency Planning Committee, Madison County Disaster and Emergency Services, and public input.

## INTRODUCTION

The Local Emergency Planning Committee, or LEPC, was conceived in the wake of the disaster in Bhopal, India, in December 1984, which resulted in more than 2,000 deaths and over 100,000 injuries, when hazardous chemicals were accidentally released from the local Union Carbide Plant. To prevent similar accidents in our communities, Congress passed the Emergency Planning and Community Right-to-Know Act (EPCRA), also known as SARA Title III in 1986. It was this federal legislation that first officially created the LEPC.

With the enactment of the Disaster Mitigation Act of 2000, the LEPC evolved into an all hazard planning organization. The legislation required each jurisdiction to develop a Pre-Disaster Mitigation Plan. Pre-Disaster Mitigation (PDM) Committees became sub-committees of the LEPC or the LEPC took on these additional duties. While DMA 2000 specifically addresses the requirement to plan for the mitigation of natural disasters, it is generally accepted that the most prudent course of action is for the LEPC to also plan for the mitigation of man made disasters, while still maintaining its original intended purpose with regard to hazardous material incidents mitigation.

With the events of September 11, 2001 and the attack on the World Trade Center in New York City by terrorists, the LEPC was thrust into yet a new role. It has now fallen to the LEPC to plan mitigation, response and recovery efforts for the possible eventuality of chemical, biological, nuclear/radiological, and conventional weapons of mass destruction, known commonly as WMD. The ability of the local government to prevent, and respond decisively to terrorist attacks against our citizens is one of the most challenging priorities facing our nation today.

The Madison County LEPC was formed on May 21, 2002. It was decided at that time that the LEPC would also serve as the PDM Committee.

Members of the LEPC represent a solid cross section of the population of Madison County and the areas of the County. Agencies represented by members of the LEPC include the Madison County Commission, Madison County Planning Department, Madison County Sheriff's Office, Madison County Disaster and Emergency Services, Madison County Grant Writer, Madison County Health Department, Harrison Volunteer Fire Department, Town of Ennis, Ennis Ambulance Service, Virginia City Volunteer Fire Department, Town of Virginia City, Sheridan Volunteer Fire Department, Town of Sheridan, Twin Bridges Volunteer Fire Department, Town of Twin Bridges, Twin Bridges Public Works Department, Twin Bridges School District.

In addition the participation of numerous other groups and interested individuals has been invited and encouraged by the LEPC. Among these groups is the Vigilante Rural Electric Cooperative, the Three Rivers Telephone Cooperative, community service organizations, and other interested emergency services personnel as well as members of the general public.

Madison County is located in the southwest corner of Montana and is largely rural. Most of the

County's land use is agricultural or forest land. There are four incorporated towns in the County. The largest, Ennis, is located in the eastern half of the County. Sheridan and Twin Bridges are located in the western half of the County. Virginia City, the County Seat, is centrally located in the County and is a historic mining town, built in 1863. Historic properties in Virginia City and nearby Nevada City are run by the State of Montana as a Historic Site. The area depends heavily on Tourism. Some mining remains in the County, most notably, 20 miles south of Ennis in the eastern half of the County and around Virginia City, Sheridan and Twin Bridges.

Madison County has an estimated 1,200 miles of County road. Roadway reconstruction costs depend on the length of the road to be reconstructed and whether the existing road has an asphalt driving surface. In general, 200 LF of roadway reconstruction is assumed for each bridge replaced to account for transitions into and out of the bridge. The estimated costs for road reconstruction vary from around \$5.00 per square yard for graveled roads to \$15.00 per square yard for asphalt surfaced roads.

There are 4,671 total housing units in Madison County. The total population is 6,851. Madison County has experienced a 14.4% population increase between 1990 and 2000. Many new residences have been built in numerous sub-divisions, the majority located in the Madison Valley around Ennis and in the Mountain Village area of the Big Sky Ski Resort Community. This development is expected to continue and increase in proportion. ( See U.S. Census Bureau statistics for 1990 and 2000 census located at the end of Appendix 2)

The Madison County Local Emergency Planning Committee has monitored the development of the Pre-Disaster Mitigation Plan and analyzed the risk assessment studies. As a result the Local Emergency Planning Committee has developed a set of goals that they determined would have the greatest benefit for the citizens of the County. These goals, objectives, and actions are set out in the mitigation strategies section of this plan.

## THE PLANNING PROCESS

The planning process is the most critical element in developing any hazard mitigation plan. It is the process that brings together the different elements of the community that are being affected by the problem.

The planning process undertaken in Madison County follows a carefully developed 10-step process that has its basis in community planning. While it is not a requirement, adhering to this process has insured a thorough planning effort. The 10-steps are:

1. Get organized to prepare the plan.
2. Plan for public involvement.
3. Coordinate with other agencies.
4. Identify the hazard(s).
5. Assess the risk.
6. Set planning goals.
7. Review possible activities.
8. Draft an action plan.
9. Adopt the plan.
10. Implement, evaluate, and revise.

Madison County has developed this pre-disaster mitigation plan through the efforts of a great number of individuals and organizations. The Madison County Local Emergency Planning Committee who is responsible for the development of the plan, held its first “Town Hall” meeting to develop the plan on October 23, 2002. In an effort to solicit public input during the planning process, articles detailing the intentions of the LEPC to draft the PDM plan and inviting the public to the meeting were published in The Madisonian, the local newspaper. In addition, invitations were sent to 42 local emergency services organizations, local service providers, communities, and public service organizations. (See appendix 2 for documentation of newspaper articles and invitation list)

The Madison County Local Emergency Planning Committee also outreached to local hospitals, nursing homes and schools in order to gather more information and involvement with the planning process. (See appendix 2 for copy of interview format used to facilitate information gathering from local hospitals, nursing homes and schools.)

The “Town Hall” meeting was attended by members of the LEPC, local emergency services personnel, local utilities representatives, local community representatives, Montana Disaster and Emergency Services representatives, and the head of Fire Logistics, Inc.

The attendees were asked to list hazards that they felt could realistically affect Madison County. Thirteen hazards were initially identified by attendees as possibly affecting Madison County. The Thirteen hazards identified were :

HAZARD	VOTES	PRIORITY	COMMENTS
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MADISON COUNTY PRE-DISASTER MITIGATION PLAN

	<b>RECEIVED</b>		
Earthquakes	7	1	Seen as number one hazard facing Madison County.
Hazard Materials	6	2	Although there no Hazardous Material Facilities in Madison County, transportation of Hazardous through the County was of great concern.
Communication Issues	6	2	This issue was considered to be of such importance that it should be addressed in every mitigation effort.
Wildfire	4	3	Seen as so important that the mitigation plan was included as a separate annex to the PDM.
Bio-terrorism/Epidemic/Health	4	3	In the wake of the attacks on New York, this was a grate concern to the residents of Madison County.
Flooding	1	4	This hazard is of particular concern in Twin Bridges, Ennis and the Waterloo area as well as several localized areas in the County.
Winter Storm	1		Discarded as this Hazard did not fall into the five.
Dams	1		Discarded as this Hazard did not fall into the five.
Mass Casualties	1		Discarded as this Hazard did not fall into the five.
Structure Fire	0		Discarded due to lack of a final vote.
Aircraft Accident	0		Discarded due to lack of a final vote.
Winder storms/Tornados	0		Discarded due to lack of a final vote.
Utility Disruption	0		Discarded due to lack of a final vote.

Each attendee was allowed three votes to pick their three highest priorities. In this manner, five hazards from the original thirteen were identified as priorities. This is reflected in the “Votes Received” and “Priority” columns of the table above.

The five hazards identified as priorities, in order of votes received, are Earthquakes, Hazard Material Incidents, Communications Issues, Wildfire, and Bio-terrorism/Epidemic/Health Issues.



Flooding was identified as another area of concern from later public feedback. Subcommittees were formed to assess and analyze each of the hazards with the exception of Wildfire. Fire Logistics, Inc. is contracted to Madison County to develop the Madison County Strategic Wildfire Plan. With this effort in progress, the avenue to address this concern is currently being conducted (See appendix 2 for membership of the subcommittees.)

In addition, follow-up questionnaires were mailed to the Madison County Planning Board, the Town Councils of Ennis, Sheridan, Twin Bridges, and Virginia City and community groups of non-incorporated towns, to ascertain their impressions of what hazards existed in their areas. This information was incorporated into the initial concerns derived from the “Town Hall” meeting. It was through this process that Flooding was identified as a hazard of concern in some areas of the county.

It was initially decided that each hazard would be addressed in its own separate annex. It was hoped that in this manner risk assessment and mitigation plan development could be accomplished in a straight forward and efficient method. However, as the plan developed and mitigation efforts were discussed, it was realized that in many respects many mitigation efforts addressed numerous hazards at the same time. It was therefore decided to abandoned the annex format and address all hazards in one undivided plan.

The communications issue was discussed at length. It was pointed out that communications was paramount to the reduction of damage and preservation of life in any disaster. It was felt that communications was so important that it deserved special treatment and has consequently been contracted for a more in-depth needs assessment that will later be incorporated into this PDM.

## **HAZARD ANALYSIS**

The hazard analysis was conducted in five separate sections representing the five hazards identified for Madison County. While the identified hazards have the potential of affecting all of Madison County, some hazards are more likely to affect particular areas of the County.

There are four incorporated towns in Madison County. Ennis, located on the Madison River in eastern Madison County; Virginia City, a historic mining town, which is centrally in Madison County; Sheridan, located in the western part of Madison County; and Twin Bridges, located on the Beaverhead River, near the Ruby River, Beaverhead River and the Big Hole River come together to form the Jefferson River.

The four communities share similar hazards, have similar geography, topography and demographics. However some of the communities are more prone to some of the identified hazards than others. Each hazard analysis identifies those communities most at risk to the identified hazard.

The Madison County Planning Office provided the data

# EARTHQUAKES

By far, earthquakes pose the largest single event natural hazard faced by Madison County. They may affect large areas, cause great damage to structures, cause injury, loss of life and alter the socioeconomic functioning of the communities of the county. Madison County lies within a zone of high seismicity, the Inter-mountain Seismic Belt, which also covers parts of Nevada, Arizona, Utah, Wyoming and Idaho. In Montana, this seismic belt trends north from Yellowstone National Park, near the south end of Madison County, to Helena, then heads northwest, terminating beyond Flathead Lake. Most of the earthquake activity in the state occurs within this zone.

Earthquakes occur along faults, which are fractures or fracture zones in the earth across which there may be relative motion. The energy released radiates outward from the source, or focus, as a series of waves - an earthquake. The primary hazards of earthquakes are ground breaking, as the rocks slide past on another, and ground shaking, by seismic waves. Secondary earthquake hazards result from distortion of the surface materials such as water, soil, or structures. The hazard of ground breaking is confined to a single fault or a narrow zone of multiple faults. Within the fault zone, which is generally less than .5 miles wide, most structures will be destroyed and utilities will be cut. In the case of a moderate, small or deep earthquake, ground breaking may not occur at all.

Ground shaking may affect areas 65 miles or more from the epicenter. As such, it is the greatest primary earthquake hazard. Ground shaking may also trigger the failure of snow (avalanche) or earth materials (landslide). Ground shaking can also change the mechanical properties of some fine grained, saturated soils, whereupon they liquefy and act as a fluid (liquefaction). The dramatic reduction in bearing strength of such soils can cause buried utilities to rupture and otherwise undamaged buildings to collapse.

The major form of damage from most earthquakes is damage to construction. Bridges are particularly vulnerable to collapse, and dam failure may generate major downstream flooding. Buildings vary in susceptibility, dependent upon construction and the types of soils on which they are built. Fires caused by ruptured gas mains may also destroy structures.

The damage caused by both ground breaking and ground shaking can lead to the paralysis of the local infrastructure: police, fire, medical and governmental services. As with many catastrophes, the worst hazard to the survivors is their own shock and inability to respond to the necessity for prompt, effective action.

Earthquakes are measured according to their intensity (observed effect) and magnitude (energy released). Intensity is an indication of an earthquake's apparent severity at a specified location, as determined by experienced observers. Magnitude expresses the amount of energy released by an earthquake as determined by standardized recording instruments.

The Modified Mercalli Scale is the method most commonly used in the United States for measuring

earthquake intensity. This twelve tier scale ranks observed effects from 1, felt only under especially favorable circumstances to XII, damage total.

The magnitude of an earthquake is most commonly measured through the use of the Richter Scale. Earthquake magnitudes describe the subject on an absolute, not an arithmetic, scale. An earthquake of magnitude 8, for example, is ten times stronger than a magnitude 7 earthquake, 100 times stronger than a magnitude 6 earthquake, and so on. There is no highest or lowest value, and it is possible here, as with temperature, to record negative values. The largest earthquakes of record were rated at magnitude 8.9; the smallest, about minus 3. The historic earthquakes of Montana were among the largest recorded on the continental United States. Measured on the Richter Scale, the 1925 Clarkston Valley earthquake was recorded at 6.75, the largest of the earthquakes located in the Helena area in 1935 was recorded at 6.25, and Hebgen Lake Earthquake on August 17, 1959, the epicenter of which was located in southeastern Madison County, was recorded at a magnitude of 7.5. The intensity of the Hebgen Lake Earthquake was rated as a X. In a study conducted by the University of Utah of major earthquakes in the Northern Rocky that had occurred between March 22, 1876 and February 3, 1994, the Borah Peak, ID. earthquake on October 28, 1983 was the only other earthquake to be rated at a magnitude 7 or greater earthquake with a magnitude 7.3. The Intensity of the Borah Peak, ID. earthquake was rated as a IX.

Madison County has experienced two major earthquakes with the epicenters located within Madison County. In addition to the Hebgen Lake Earthquake of 1959, the Virginia City Earthquake on November 23, 1947 was rated at a magnitude of 6 ¼ with an intensity rated at VIII. (See supporting documentation in appendix 3 for newspaper documentation of both earthquakes.) Madison County has also experienced the effects of several other major historic earthquakes in southwest Montana that were not officially centered within Madison County

Since earthquakes are usually associated with faulting, any region containing active faults is potentially dangerous. Madison County contains many active fault systems throughout the county. The southeastern corner of Madison County where the Hebgen Lake Earthquake epicenter was located has a Peak Acceleration rating of 30 with most of the rest of the county being rated at greater than 10 according to the U.S. Geological Survey, National Seismic Hazard Mapping Project. Madison County is a very active earthquake area and experiences many small earthquakes every year. (See EQ-MAP 1 and EQ-MAP 2 at the end of this section for maps documenting the earthquake activity in Madison County)

Experts estimate the likelihood of earthquakes recurring within a given time frame and a given area. Some of these findings are:

In all of western Montana an event of magnitude greater than 5.0 can be expected every 1.5 years, a magnitude of 6.0 or greater should occur ever ten years, and a magnitude 7.0 or greater should occur every 77 years.

The highest recurrence rate of large earthquakes in Montana occurs in the Hebgen Lake-Yellowstone Region, followed by Helena and Three Forks. The Hebgen Lake Region is located near the southeast corner of Madison County.

Source: U. S. G. S. Earthquake Hazards Program

Earthquakes most commonly occur in the same place as prior earthquakes, that is, along active faults. The term active is often interpreted by non-scientists as meaning active during historical time (the last 100 years). Active faults are most commonly indicated by micro-seismicity (earthquakes so small they can only be detected by instruments) and by the presence of scarps. Scarps are steep, linear slopes, up to 65 feet high, showing offset of the ground surface. They are commonly found along the base of mountain ranges, and are prominent in the Madison and Yellowstone Valleys. The Madison Valley makes up the eastern half of Madison County with the south end of the valley laying within 10 miles of Hebgen Lake.

Montana has experienced many major earthquakes in the past. There is every reason to believe that similar events will occur in the future. Future earthquakes will, in general, occur where they have been recorded or where evidence is preserved of their prehistoric occurrence.

The earthquake sub-committee conducted extensive study on the location of earthquake faults and scarps, and the location of prior earthquakes in Madison County. This study was conducted with the assistance of the Montana Bureau of Mines and Geology, Montana Tech, University of Montana. (See map EQ-MAP 1 at the end of this section for location of faults and past earthquakes in Madison County)

Over 75% of the buildings in Madison County are pre-seismic code structures or recent constructions not built to seismic code. This includes all county and city governmental buildings. While the vast majority of the residential buildings are of wood-frame construction, many have masonry chimneys.

The western half of the county has several major faults systems. These are located near the towns of Sheridan and Twin Bridges. One fault system runs directly through the community of Alder. A major earthquake along any one of these fault lines would be devastating to these communities. Fire stations in Sheridan and Twin Bridges are of masonry construction. The Town Hall for both communities are located within the same Fire Station buildings. Water and sewer systems in both communities would suffer profound damage, eliminating service to the population. Both the Ruby Valley Hospital, the only medical facility within 34 miles, and the Tobacco Root Care Center, the nursing home in Sheridan, are of masonry construction.

The Madison County Courthouse located in Virginia City was constructed in 1872 and is of masonry and stone construction. This building houses most of the county government offices. This includes the Sheriff's Office in the basement of the Courthouse which is the 911 center and

Emergency Operations Center and handles all emergency communications for the entire county. The Virginia City Town Hall as well as 4 other county government offices, including the county Disaster and Emergency Services Office are located in the old Virginia City School building, which was constructed in the early 1900s and is of masonry construction. Both buildings were damaged in the 1959 Hebgen Lake Earthquake.

The east half of the county has experienced numerous earthquakes in the past. It has experienced 5 earthquakes since 1900 of magnitudes 5.5 or greater. This includes the 1959 Hebgen Lake Earthquake which had a magnitude of 7.5 and an intensity of X. ( See Table EQ-TABLE 1 at the end of this section for list of documented earthquakes that have impacted Madison County)

In addition, the Madison Valley exhibits numerous scarps and faults. Faults in the Madison Valley are, starting at the south end of the valley proceeding north, The Madison Fault, The Graben Scarp, The Wolf Creek Scarp, The Indian Creek Scarp, The Bear Creek Scarp, The Burger Creek Scarp, and The Jack Creek Scarp.

The Town of Ennis is located in the north end of the Madison Valley. The Ennis Town Hall, The Ennis Police Department and the Ennis Ambulance Service are located in a building that was built in the 1950 of masonry construction. This building suffered damage in the 1959 Hebgen Lake Earthquake. An earthquake in the Ennis area of the magnitude of the Hebgen Lake Earthquake would devastate the community. Water and sewer lines have already suffered damage from the several of the minor earthquakes in the area. In addition to the town hall, the Madison Valley Hospital, the Madison Valley Manor, and the Ennis High School and Ennis Elementary School are vulnerable to damage.

There are 7 schools, 2 hospitals, 2 nursing homes, 8 fire stations, 4 town halls, 1 county courthouse and two county government buildings as well as 4,671 residential buildings in Madison County. Any or all of the residential structures, in addition to the government infrastructure, could be affected by earthquake depending on location and magnitude. The Peak Ground Acceleration for Madison County ranges from 10 in the northwest corner to 30 in the southeast corner. (See map EQ-MAP 2 at the end of this section, PGA values for Madison County)

The Local Emergency Planning Committee used the guidelines in the FEMA document *Understanding Your Risk: Identifying Hazards and Estimating Losses* to develop a cost estimate for damage. The estimated costs are as follows:

■	County owned buildings	\$1,580,267.38
■	Madison Valley Manor (Nursing home)	\$1,021,228.91
■	Tobacco Root Mountains Care Center (Nursing home)	\$ 355,117.40
■	Infrastructure - Bridges, Culverts, Sidewalks, Etc.	\$1,790,804.66
■	Residential properties	
■	2 Hospitals	
■	Schools	
■	City Government buildings	
■	Water systems and Sewer systems	

## EQ-TABLE 1

### Earthquakes Impacting Madison County

Date	Common Name	Magnitude	Intensity
June 27, 1925	Clarkston Valley, MT	6 3/4	VIII
February 29, 1928	Helena, MT	5 1/2 +/-	IV
February 15, 1929	Lombard, MT	5.6	V
October 18, 1935	Helena, MT	6 1/4	VIII
November 23, 1947	Virginia City, MT	6 1/4	VIII
August 17, 1959	Hebgen Lake, MT	7.5	X
June 30, 1975	Yellowstone, WY	6.1	VII

Source: University of Utah Seismograph Station

## EQ-TABLE 2

### Major Earthquakes in the Northern Rockies 1876 - 1994

Date	Common Name	Magnitude	Intensity
Mar 22, 1876	Moroni, UT	5.0	VI
Nov 10, 1884	Bear Lake, ID	6.3	VIII
Dec 05, 1887	Kanab, UT	5.7	VII
Apr 20, 1891	St. George, UT	5.0	VI
Jul 18, 1894	Ogden, UT	5.0	VI
Aug 01, 1900	Eureka, UT	5 ½ +/-	VII
Nov 13, 1901	Southern UT	6 ½ +/-	IX
Nov 17, 1902	Pine Valley, UT	6 +/-	VIII
Nov 11, 1905	Shoshone, ID	5 ½ +/-	V
Apr 15, 1908	Milford, UT	5.0	VI
Oct 05, 1909	Hansel Valley, UT	6 +/-	VIII
Jan 10, 1910	Elsinore, UT	5.0 +/-	VI
May 22, 1910	Salt Lake City, UT	5 ½	VII
May 13, 1914	Ogden, UT	5 ½ +/-	VII
Jul 15, 1915	Provo, UT	5.0	VI
Sep 29, 1921	Elsinore, UT	6 +/-	VIII
Jun 27, 1925	Clarkston Valley, MT 6 ¾		VIII
Feb 29, 1928	Helena, MT	5 ½ +/-	IV
Feb 15, 1929	Lombard, MT	5.6	V
Jun 12, 1930	Grover, WY	5.8	VI
Jan 20, 1933	Parowan, UT	5.0	VI
Mar 12, 1934	Hansel Valley, UT	6.6	IX
Oct 18, 1935	Helena, MT	6 ¼	VIII
Aug 30, 1942	Cedar City, UT	5.0	VI
Sep 26, 1942	Cedar City, UT	5.0	VI
Feb 22, 1943	Magna, UT	5.0	VI
Jul 12, 1944	Central Idaho	6.1	VII
Feb 13, 1945	Central Idaho	6.0	VI
Sep 23, 1945	Flathead Lake, MT	5.5	VI
Nov 17, 1945	Glenwood, UT	5.0	VI
Nov 23, 1947	Virginia City, MT	6 ¼	VIII
Mar 06, 1949	Salt Lake City, UT	5.0	VI
Mar 31, 1952	Big Fork, MT	5.5	VII



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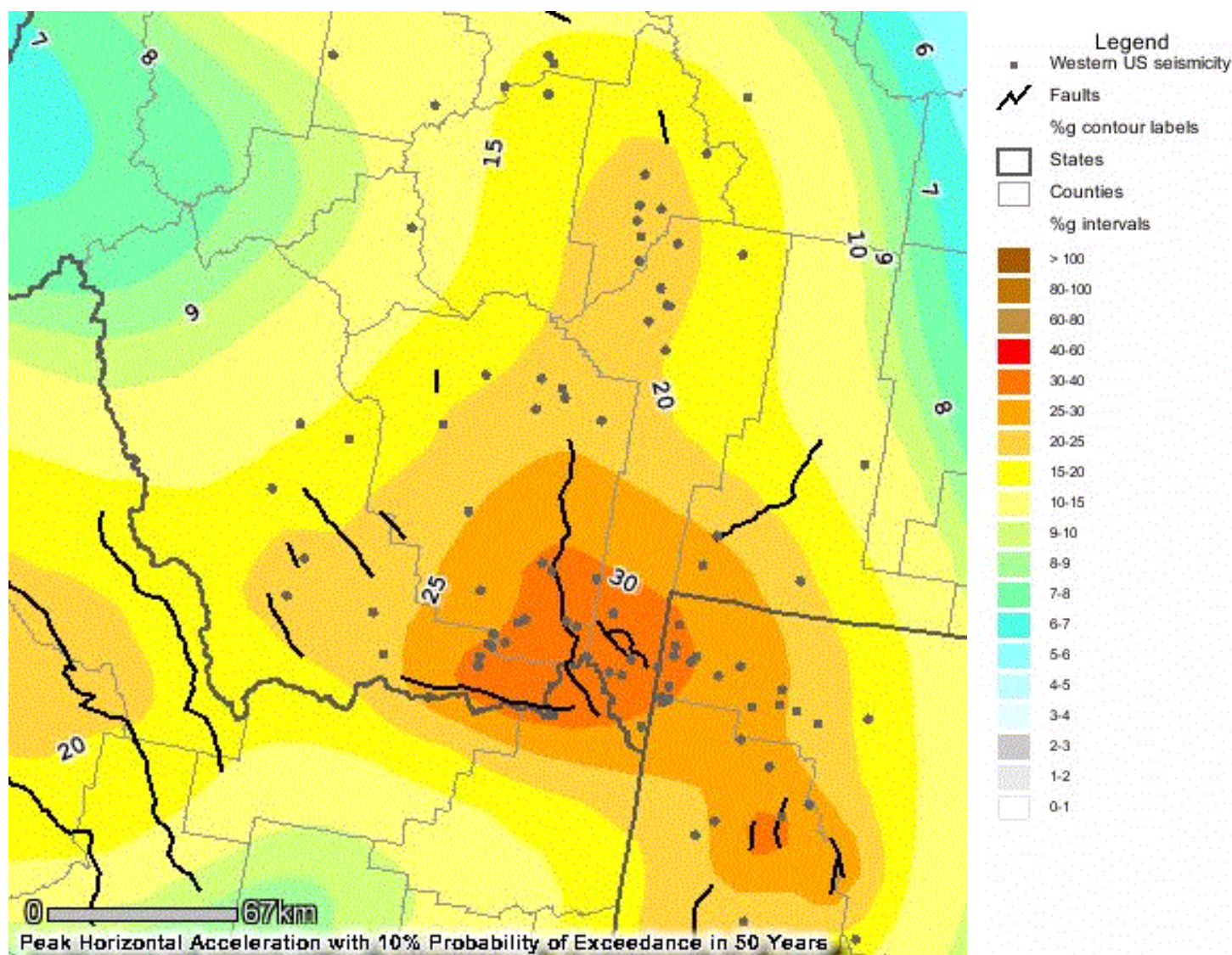
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Feb 13, 1958	Wallsburg, UT	5.0		VI
Feb 27, 1959	Panguitch, UT	5.0	VI	
Jul 21, 1959	Southwest UT	5.7		VI
Aug 17, 1959	Hebgen Lake, MT	7.5		X
Apr 15, 1961	Ephraim, UT	5.0		VI
Aug 30, 1962	Cache Valley, UT	5.7		VII
Sep 05, 1962	Magna, UT	5.2		VI
Oct 04, 1967	Marysvale, UT	5.2		VII
Mar 27, 1975	Pocatello, ID	6.0		VIII
Jun 30, 1975	Yellowstone, WY	6.1		VII
Oct 28, 1983	Borah Peak, ID	7.3		IX
Aug 14, 1988	San Rafael Swell, UT	5.3		VI
Jan 29, 1989	So. Wasatch Plateau, UT	5.4		VI
Sep 02, 1992	St. George, UT	5.8		VII
Feb 03, 1994	Draney Peak, ID	5.9		VII

Source: University of Utah Seismograph Station

# EQ-MAP-1



EQ-

MAP-2

## **Earthquake Vulnerability**

Since earthquakes are usually associated with faulting, any region containing active faults is potentially dangerous. As stated earlier, Madison County contains many active fault systems throughout the county. The southeastern corner of Madison County where the Hebgen Lake Earthquake epicenter was located has a Peak Acceleration rating of 30 with most of the rest of the county being rated at greater than 10 according to the U.S. Geological Survey, National Seismic Hazard Mapping Project. Madison County is a very active earthquake area and experiences many small earthquakes every year.

In all of western Montana an event of magnitude greater than 5.0 can be expected every 1.5 years, a magnitude of 6.0 or greater should occur every ten years, and a magnitude 7.0 or greater should occur every 77 years. The highest recurrence rate of large earthquakes in Montana occurs in the Hebgen Lake-Yellowstone Region, followed by Helena and Three Forks. The Hebgen Lake Region is located near the southeast corner of Madison County. Three Forks is less than 10 miles from the County line on the northeast corner of the County. Helena is just 40 miles north of Madison County.

Given the statistical frequency of major earthquakes in an active earthquake area, and the time since the last major earthquake in Madison County, it is easy to recognize that the County is facing another major event in the near future. All of Madison County will remain vulnerable to the threat of Earthquake, as the County lays within one of the most geological active areas in the United States.

With the continued increase in population of the County, and a median housing value of \$104,500, damage to residential property alone will be in the millions. This does not take into account the cost of deaths and injuries, or the value of critical structures and infrastructure.

Because it is impossible to predict where and to what magnitude an earthquake might strike Madison County, it is also impossible to define a hazard area.

Due to the unpredictable nature of earthquake, the probability of an event can only be considered as moderate. The magnitude of the impact on the community however must be considered high. Earthquake was prioritized as the number 1 identified hazard, having been the greatest concern to the citizens of Madison County.

### **Community Earthquake Vulnerability**

Ennis, Virginia City, Sheridan, and Twin Bridges are all vulnerable to Earthquake. As with the rest of the County they all exist within a very active earthquake region. The un-incorporated community of Norris in northeastern Madison County has the highest recorded occurrences of earthquake.

## HAZARDOUS MATERIALS

Major disasters like that in Bhopal, India in December 1984 are rare. Reports of spills and releases of hazardous materials, however, are increasingly commonplace. Thousands of new chemicals are developed each year. Citizens of Madison County are concerned about accidents (e.g., highway incidents, warehouse fires, train derailments, shipping accidents,) happening in Madison County. As evident by the results of the “Town Hall” meeting, many people in Madison County consider hazardous materials incidents to be one of the most significant threats facing the County.

The U.S. Department of Health and Human Services (HHS) gathered data on hazardous substance emergency events from 13 states between 1993 and 1998. This study shows that the number of fixed-facility and transportation-related hazardous substance emergency events increased by 53 percent between 1993 and 1998.

Because of the risk of incidents involving hazardous materials and because it is understood that local governments will be completely on their own in the first stages of almost any such incident, communities need to maintain a continuing preparedness capacity.

Hazardous materials refers generally to hazardous substances, petroleum, natural gas, synthetic gas, acutely toxic chemicals, and other toxic chemicals. Extremely hazardous substances is used to refer to those chemicals that could cause serious health effects following short-term exposure from accidental releases. EPA has listed 356 extremely hazardous substances for which emergency planning is required.

Madison County has no major fixed hazardous material facilities with the exception of gas and propane storage facilities. The concern of all involved participants in the Pre-Disaster Mitigation planning process is an accident involving hazardous material in transit through Madison County. This could occur on one of the major highway corridors through Madison County or along the rail lines running along the northwestern border of the County.

Incidents involving the release of Hazardous Materials are commonly referred to as hazmat incidents. Any hazmat incident occurring within Madison County would immediately overwhelm the response capability of the emergency services in Madison County. No agency in Madison County has a hazmat response capability.

Worst case scenarios are those involving hazmat incidents in one of the more densely population centers in Madison County. This could very easily occur in either Twin Bridges or Ennis as both communities have major transportation routes going through the town, and in both cases carriers must come to a complete stop at a “T” intersection.

A commercial carrier transporting hazardous materials north along MT. Hwy. 41 must stop at the

intersection of MT. Hwy. 41 and MT. Hwy. 287 in downtown Twin Bridges. If the carrier was to fail to stop or fail to negotiate this turn, it would literally impact the downtown business district of Twin Bridges. Buildings potentially damaged include the Ruby Valley National Bank, U.S. Post Office, Blue Anchor Bar, Blue Anchor Cafe, NAPA Store, Headwater Reality, McAlear Pharmacy and Groceries Store. This would also cause a major hazmat release in downtown Twin Bridges. This area is also located less than two blocks from the Twin Bridges High School and the Twin Bridges Elementary School.

A commercial carrier transporting hazardous materials south along U.S. Hwy. 287 must stop at the intersection of U.S. Hwy. 287 and MT. Hwy. 287 in Ennis. If the carrier was to fail to stop or fail to negotiate this turn it would crash into the Ennis Elementary School grounds. A hazmat release at this point would impact the Ennis Elementary School, the Ennis High School, the Madison Valley Manor (a nursing home), the Madison Valley Hospital and Clinic, the Ennis Community Children's School, and the Town Pump gas station.

The greatest concern in a hazmat incident is loss of life due to exposure to the hazardous material. Considering the potential incident in Ennis the number of individuals affected would include: the patients and staff at the Madison Valley Hospital and Clinic, an 11 bed hospital with a normal staff of 14 between the hospital and the clinic; The patients and staff at the Madison Valley Manor, a 40 bed nursing home with a normal staff of 16; The Ennis Elementary School with an enrollment of 180 and a staff of 20; The Ennis High School, with an enrollment of 132 and a staff of 41; Ennis Community Children's School, a Day Care with an enrollment of between 20 and 40 and a staff of between 3 and 5. As the Office of Budget Management has set the cost of a human life at \$2.5 million for the purposes of figuring risk cost benefits, the cost of a hazmat incident at this intersection, in terms of loss of human life alone, could be as high as \$1,197,500,000.00.

The following is the report presented by the Hazmat Sub-Committee to the LEPC:

#### Hazardous Materials:

##### Highest Concerns:

- Communications - Having adequate communications devices throughout the County to properly notice emergency services personnel of hazard disaster or problem. Two-way radios, cell phone and telephone services that fully cover County with no interruption opportunity.
- Training - Emergency services personnel require training to fully understand all potential hazard prospects. Knowing when to approach hazard, when not to approach hazard, what steps to take, who to contact, what to do with general public observers, knowing signs of various hazardous materials from distant observation (re: flame color, vapor color, odor, etc., if I can smell it, am I too close?), Personal Protective Equipment, etc.
- Equipment - Personal Protective Equipment, manuals, communications,

- multi-demand equipped vehicles, knowing outside resources that have equipment available to assist, training to use specialized equipment, etc.
- Other resources - Emergency services personnel should have contact and agreement with other like services for full accounting of: who can assist, who is best suited to assist, who is close, what equipment and other resources do they have available, (re: Is there a hazmat team from Malmstrom AFB, are they a bomb squad, are they available for assistance w/ hazmat spill?)

Types of Hazardous Materials that are known to exist in Madison County:

1. Propane - delivery trucks, residential tanks vehicles using propane as fuel etc.
2. Fuels - Gas, Diesel
3. Numerous Chemicals
  - Mining related
  - Those being transported throughout the County unknown to public or emergency services
  - Fertilizers
  - Herbicides, pesticides
  - Household
  - Cars & Trucks - What are all those vehicles traveling thru the County carrying?
  - Cars & Trucks - Fuels, petroleum; new bumpers that can blow like a missile; etc.

Discussion of other items included:

- Hazards with Meth-labs and associated investigation
- Question of State and Interstate regulations on transportation of hazardous materials
- Driver log book and Driver required documentation of payload
- Concern that Big Sky likely is the place in the County that would have more high profile visitors at one time might make this resort our highest risk target by terrorist or other wishing to make headlines
- Commissioners had, on 11-04-02, presented residents at Big Sky the hazard list for their input.

### **Hazardous Material Vulnerability**

Madison County has several major transportation routes traversing the County. All of these highways provide avenues of transit for vehicles carrying hazardous materials.

With the restriction on hazardous cargo on Highway 191 which runs through a section of Yellowstone National Park, many carriers have been forced to reroute along U.S. 287, which runs the length of the eastern half of Madison County, through the Madison Valley. Most of this route runs along the Madison River, a blue ribbon trout stream.

Montana Highway 41 in northwestern Madison County provides a “short cut” between Interstate 15 and Interstate 90, by passing Butte and two steep hills that must be climbed if the carrier makes the same connection staying on Interstate.

As it is impossible to predict where along any of these routes a hazardous materials spill may occur, the majority of the county, and all population concentrations must be considered vulnerable to hazardous material spills.

### **Community Hazardous Material Vulnerability**

All four of Madison County’s incorporated towns are vulnerable to Hazardous Material spills. All are located along highways that are used by truck traffic. Ennis and Twin Bridges are potentially more at risk for Hazardous Material spills as the highways through these communities historically experience a higher proportion of the truck traffic that do Sheridan or Virginia City.



## **BIO-TERRORISM / EPIDEMIOLOGY**

Well developed surveillance and epidemiologic capacity is the foundation on which health departments detect, evaluate and design effective responses to terrorism events. Not only does this capacity facilitate the initial detection and response in a terrorism event, it is essential to monitoring the impact of these events and the effectiveness of public health responses. Detection of acute or insidious terrorism attacks using biological or chemical agents also requires linking of data from a variety of sources. An effective public health response depends on the timeliness and quality of communications among numerous partners' health agencies at local, state, and federal levels.

Complementing the need for accurate and timely case reports is the need for expertise to analyze the information properly. Epidemiologic expertise is critical to judging whether the incident involves biological or chemical agents or is a consequence of a natural phenomenon, an accident or terrorism. Timely and accurate information and analysis must be coupled with effective and rapid dissemination of information to those who need to know.

Extraordinary measures are not necessary to develop a comprehensive terrorism health surveillance and epidemiologic network. Initiating partnerships and developing new or pre-existing data links have always been components of public health systems while using current technology to promote timely disease identification and reporting. Those links rarely have been with emergency management and law enforcement entities. This can improve the daily capacity of Madison County to respond to illness and disease regardless of the magnitude.

Madison County Public Health Department possess the legal authority to receive reports and investigate unusual illness clusters. It is not adequately developed to perform the surveillance and epidemiologic functions needed to protect the citizens of Madison County. The health care system lacks the capabilities needed to effectively handle large numbers of victims. There are currently no negative pressure rooms in Madison County making strict isolation impossible for contagious patients. There is inadequate personal protection gear to care for certain types of contagents or exposures. Reaching out to develop mutual aid agreements with other health care institutions has been slow. Training for health care providers in the handling of bio-terrorism victims has been infrequent.

### **Bio-Terrorism / Epidemiology Vulnerability**

In the wake of the terrorist attacks on New York City, Bio-Terrorism has become a major concern to the citizens of Madison County. Not only in terms of human exposure but Madison County is a large livestock producing area and a terrorist initiated release of a virus such as Hoof and Mouth would be totally devastating to the economy in addition to being a public health crises.

Madison County is rural in character and sparsely populated. The county is however located down

wind from large metropolitan areas. An example of these wind patterns was demonstrated by the large quantity of ash that fell across the County when Mt. St. Helens in Washington State erupted. It is conceivable that the same wind patterns could carry a virus released in a large west coast population area to Madison County.

In addition, Madison County is a popular tourist destination. The County also has a substantial transient population. Any of these two groups that may pass through the County after being exposed to a virus could potentially start an epidemic.

Lacking the resources of larger population areas, any exposure to one of these viruses would quickly overwhelm County Public Health capabilities.

### **Community Bio-Terrorism / Epidemiology Vulnerability**

All four of Madison County's Incorporated Towns are equally vulnerable to the threat of the Bio-Terrorism / Epidemiology hazard. All four communities have a vibrant tourist industry. All four communities share a location and wind patterns that would potentially leave them vulnerable to biological events or epidemics.

# **WILDFIRE**

At the time that the Pre-Disaster Mitigation Plan was undertaken in Madison County, the wildfire situation was already under study through a contract between Madison County and Bruce Suenram of Fire Logistics, Inc. This plan, known as The Madison County Strategic Wildland Fire Plan, is intended to perform the same efforts that the LEPC was required to perform in respect to the wildfire hazard in Madison County. It was therefore decided to incorporate the Fire Plan into the PDM. (See appendix 1)

## **Wildfire Vulnerability**

As exemplified by the wildfires that western Montana has experienced since 1988, Montana and Madison County are suffering a multi-year drought. Fire fuels continue to build up. The fuels are very dry and do not recover over the winter months.

Add to this an ever increasing wildland-urban interface zone that has occurred in Madison County due to an increase in population. Many of the new structures in Madison County are located in this wildland-urban interface zone as more and more people attempt to build in more secluded and picturesque locations.

These vulnerabilities are discussed in more detail in Appendix 1.

## **Community Wildfire Vulnerability**

While all four of Madison County's Incorporated town are vulnerable to wildfire, due in part to an ever increasing wildland-urban interface zone and continued drought, Virginia City and the historic properties surrounding it are at the greatest risk of wildfire.

Virginia City is a historic mining town established in 1863. Many of the original buildings have been preserved and are a State Historic Site. These are all wood-frame buildings that were built over 140 years ago and are "tinder box" dry. To add to this plight, many share a common wall or connected in one fashion or another. Many are located in or very near wildland-urban interface zones.

These vulnerabilities are discussed in more detail in Appendix 1.

# FLOODING

## Flooding in Madison County

While flooding has presented a historic and persistent problem in Madison County, the PDM Flood Subcommittee found little data with which to accomplish the necessary risk assessment. Outside of anecdotal information, some photo documentation, and sparse newspaper articles little specific information exists to document the recent historic (mid-1800s to present) extent of flooding, nor to document damage and damage costs. A summary of news accounts reports generally on recorded flooding events from 1876-1956 in the Ruby, Beaverhead, Big Hole, and Jefferson watersheds (Holbert 1958). Eight events are reported by Holbert - 1876, 1908, two in 1915, 1927, 1937, 1955, and 1956. For the 6 that the month of flooding was available, all occurred in May or June. Information (ground and aerial photography, flow data) is available from the U.S. Geological Survey (USGS), the Natural Resources Conservation Service (NRCS) and the Madison County Sanitarian's Office documenting flooding events along the Big Hole River in June 1972, along the Ruby River in 1984, and along the Big Hole, Jefferson, and Madison Rivers in June 1997.

Flooding is defined as "the temporary inundation of lands not normally subject to flowing or standing water which causes or threatens to cause damage" (USDA-SCS 1986). It is obvious that these events will continue to occur in Madison County on regular intervals. Due to relatively long intervals between major events, complacency on the part of residents, as well as officials charged with minimizing flooding hazards and risks and protecting public investment in infrastructure, is a concern. It appears that the highest risk for flooding occurs in the months of May and June, during snowmelt runoff sometimes increased by high rainfall. The very large drainage areas of the rivers of Madison County, emphasized by the fact that they are the headwaters of the Missouri River, creates a high potential for movement of large volumes of water over short periods of time.

An Arc View GIS map of Madison County areas believed subject to frequent flooding (compiled by NRCS) is provided as Figure 1. This digital coverage is useful for identifying risk-prone land on a broad scale but is not accurate enough to provide for risk or vulnerability assessments of the hazard of flooding in Madison County. Considerable low-lying areas of the County are subject to flooding, and much lies within the 100-year floodplain. When viewed in greater detail, and in combination with an available preliminary mapping database of existing roads and structures, this coverage reveals areas of Madison County most at risk.

Flooding occurs when the amount of water arriving on land (from rainfall, snowmelt, surface flow or flow in watercourses) exceeds the capacity of the land to discharge that water (by infiltration, surface flow, piped drainage or surface watercourse). It can occur on any level or near level areas of land but the main concern is with areas adjacent to watercourses - the flood plain. It is difficult to determine the precise limits of floodplains as floods with similar probability can arise from different combination of events and result in different levels of impact. Importantly, a major component of a

healthy river system (fish and wildlife, good water quality, erosion control, sediment transport, etc.) is related to the river's ability to access its floodplain on a periodic basis.

Flooding in the past 100 years or so has occurred in all the major river systems in Madison County - including the Madison, Ruby, Beaverhead, Big Hole and Jefferson Rivers. Steep mountain drainages in many watersheds create conditions where flash flooding and rapid runoff of spring snowmelt and high precipitation can result in flooding, even though floodplains in these streams and creeks may be narrow or non-existent. High, unpredictable stream flows and intense periods of runoff may result in conditions that are life threatening for those that live in close proximity to mountain streams and drainages. Resources available on the Internet to monitor flood events and estimate the risks associated with major events include USGS Stream Flow Data and NRCS Streamflow Forecasting. An example of peak streamflow data (historic and current) is provided below for the Jefferson River near Twin Bridges. Similar data, including real time flow data from USGS gauges is also available for the Madison River, Ruby River, Beaverhead and Big Hole River (<http://waterdata.usgs.gov/mt/rwis/rt>). When used in conjunction with elevational data for neighboring lands areas subject to flooding during these types of flood events can be identified. As well winter snowpack and moisture monitoring by the USGS and other agencies can help identify years and periods when intense runoff events may result in flooding.

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**Annual Peak Streamflows at USGS Gauge # 06026500 Jefferson River near Twin Bridges MT, 1942-2003**

Madison County, Montana

Hydrologic Unit Code 10020005

Latitude 45°36'50", Longitude 112°19'45" NAD27

Drainage area 7,632.00 square miles

Gauge datum 4,560 feet above sea level NGVD29

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1942	May 28, 1942		13,200	1969	May 22, 1969	7.51	10,400
1943	Jun. 01, 1943		10,200	1970	Jun. 10, 1970	7.69	10,500
1958	May 27, 1958	7.04	8,140	1971	Jun. 02, 1971	7.34	10,000
1959	Jun. 10, 1959	6.94	8,040	1972	Jun. 03, 1972	8.25	12,900
1960	Mar. 29, 1960		6,270	1994	Apr. 24, 1994	7.50	3,400 <sup>2</sup>
1961	Jun. 13, 1961	5.89	5,460	1995	Jun. 08, 1995	12.60	14,000

1962	Jun. 16, 1962	6.42	6,820	1996	Jun. 11, 1996	12.00	13,100
1963	Jun. 25, 1963		8,240	1997	Jun. 09, 1997	12.42	15,200
1964	Jun. 10, 1964	9.04	16,500	1998	Jun. 27, 1998	9.66	8,300
1965	Jun. 18, 1965	8.13	12,700	1999	May 31, 1999	10.08	9,220
1966	Apr. 05, 1966	4.53	3,290	2000	May 30, 2000	6.33	2,950
1967	Jun. 08, 1967	7.55	10,100	2001	Jun. 16, 2001	6.39	3,030
1968	Jun. 12, 1968	6.71	8,190	2002	Jun. 03, 2002	8.37	6,050

Stream and river channels have been straightened, deepened, widened, lined, reshaped, and routed through pipes and culverts with profound effects on the stability and integrity of natural systems. Traditional engineered designs were primarily implemented in response to public requests for protection from floods, as more communities, farms, homes, and infrastructure were located on the floodplain. These encroachments, in turn, caused river adjustments increasing the perceived need for additional hard engineering controls further changing the natural function and value of many rivers. Societal values have changed and new challenges exist, including restoring natural stability and functions of rivers, and initiation of efforts to avoid problematic encroachment into floodplains and flood ways of rivers and streams (Rosgen 1996).

### **Dams and Flooding**

Five major dams built in the 1950s and 1960s exist on rivers that flow through Madison County - the Hebgen Lake Dam and the Ennis Lake Dam on the Madison River, the Ruby Reservoir Dam on the Ruby River, the Clark Canyon Dam on the Beaverhead River, and the Harrison Lake Dam on Willow Creek (Fig. 1). Three - Ennis, Hegben, and Clark Canyon - are hydro power dams while the Ruby Reservoir and Harrison Lake Dams are for storage of irrigation water. The potential for dam failure and catastrophic downstream impacts cannot be overlooked in an area subject to earthquakes and intense spring snowmelt and runoff events. Based on news accounts there was concern about the integrity and possible failure of the Hegben Lake Dam immediately following the 1959 earthquake in that area. Four lives were lost and considerable property damage occurred in 1927 along the Big Hole River when the Pattengail Dam on the Wise River failed during a spring snowmelt event, combining reservoir flows with existing high flows from snowmelt (USDA-SCS 1986). The resultant flows were the highest ever measured on the Big Hole River by the USGS and caused considerable damage to structures and bridges in Wise River and downstream.

Annual dam inspections are conducted by the Water Operations Bureau of the Montana Dept. of Natural Resources and Conservation, in conjunction with the entity responsible for the structures. The history of these dams and the annual inspection reports should be reviewed for information

pertinent to the assessment of flooding risks and the vulnerability of downstream structures and infrastructure. The Madison County Sheriff's Office is reported to have information on the concern of dam "breaching" and associated risks but this has not been reviewed.

### **Impacts from Flooding**

As noted above, information on actual damage and dollar costs of damage from past flooding events in Madison County is limited. Photography available of the 1927 flooding along on the Big Hole River (USDA-SCS 1986) and the Big Hole, Jefferson, and Madison Rivers in June 1997 show impacts and damage to buildings and agricultural operations and infrastructure such as bridges and roads along and across these rivers.

Vulnerable and at risk from the impacts of flooding in Madison County are many private structures, including those associated with residential and commercial development and agriculture operations, and considerable investment in public infrastructure such as roads, bridges, and utilities. Overlays of structures and roads in Madison County are available and can be used in conjunction with the map of areas subject to flooding to identify targets that might be impacted. Facilities at risk and the level of risk can be generally summarized as follows:

Residential structures - high

Commercial structures - low

Agricultural structures (buildings, fences, diversions, etc.) - high

Agricultural cropland - high

Roads - high

Bridges - high

Utilities - low

As well, immediate and long-term secondary impacts of flooding to Madison County will be felt in other sectors of the community and its economy. Impacts to irrigation and crop and animal production can be expected as can impacts to outdoor recreation and the economy that depends on it.

Public water supplies in and around developed communities are threatened and often impacted by flooding events, including through contamination and the disruption of distribution systems.

Prediction of to what extent these facilities will be damaged by various size flooding events, the costs of repairing and replacing damaged structures and land forms, and any form of a meaningful cost-benefit analysis for mitigation efforts, such as hardening of targets at risk and elevating structures, are all beyond the scope of this assessment. These valuable determinations should be made as part of the next phase in flood hazard identification, assessment, and mitigation in Madison County.

## **Madison County Floodplain Management**

Meaningful floodplain management exists in Madison County in the form of a Flood Plain Management Ordinance and as a result of including flood plains as an important consideration in the review of proposed subdivisions (Madison County 2000). Flooding is considered a hazard that can preclude subdivision development, review by the Floodplain Management Section of the Montana DNRC may be required, and compliance with the County Floodplain Management Ordinance is required. Recognition is made of the fact that unsuitable floodplain development can pose a threat to the health, safety, and welfare of existing and future residents.

The Big Hole Planning Group (working with 4 counties) is proposing for consideration by the Madison County Commission and others management of the floodplain along the Big Hole River and propose to map the 100-year floodplain along the river.

## **Recommended Flood Hazard Mitigation Efforts**

### ***Floodplain Mapping***

Many communities have mapped floodplains taking into account information such as the location of historic flood events, peak surface flow, and flood and land elevation models. Flood Insurance Rate Maps (FIRMs) maintained by the Federal Emergency Management Agency (FEMA) are the result of formal floodplain mapping efforts and are a critical first step in evaluating flood hazard risks and implementing mitigation strategies. The goal of these strategies is to prevent loss of life and minimize damage to infrastructure and private and commercial property. Although Madison County includes 5 major river systems forming much of the headwaters of the Missouri River, FIRMs exist only for the relatively small incorporated areas of Twin Bridges (1986) and Ennis. For example, flood prone areas of Twin Bridges are mapped as Zone A - Within the 100 year floodplain; Zone B - Within the 100-500 year floodplain; and Zone C - Areas of minimal flooding. A general discussion of floodplains, flood hazards, flood ways, development constraints, the Montana Flood way Management and Regulation Act, and the National Flood Insurance Program can be found in the 2003 Twin Bridges Growth Policy Plan.

And as reported by FEMA on the agency website: "This is an exciting time for the NFIP Flood Hazard Mapping Program. FEMA has launched an ambitious Map Modernization program to speed flood map updates. We are working with local communities and other agencies to tap into their mapping expertise as it applies to flood maps. We are exploring use of cutting edge technology to map larger areas at a small fraction of the cost". (<http://www.fema.gov/library/prepandprev.shtm>)



Examples of literature and information available from FEMA for communities and agencies interested in mapping flood prone areas include:

*Mitigation's Flood Hazard Mapping Services*

*Compendium of Flood Map Changes Archive*

*Modernizing FEMA's Flood Hazard Mapping Program: Map Modernization Progress Reports*

*Flood Hazard Mapping Bulletin Archive*

*April 2003 Edition of the Guidelines and Specifications for Flood Hazard Mapping Partners*

### **Flood Mitigation Resources Available**

Considerable on-line resources related to floodplain mapping are available from FEMA's website library for hazard preparation and prevention at <http://www.fema.gov/library/prepandprev.shtm>:

#### ***Hazard Preparation & Prevention/Mitigation Literature***

(Some of the files are provided in Adobe Acrobat Portable Document Format. All PDF documents on the FEMA Web site are characterized by the following or similar graphic icon ( ).)

#### **FEMA Mitigation Division - Insurance & Mitigation Resources**

Flood Insurance

Flood Hazard Mapping

Floodplain Management

State & Local

Dam Safety

Earthquakes

Fires

Official Publications

Hurricanes

Tornados

Multi-Hazard

Floods

#### ***Flood Insurance:***

##### ***General Publications***

Answers to Questions about the NFIP

Avoiding Flood Damage: A Checklist for Homeowners -- 178 KB

Coping with a Flood - Before, During & After

Flood: Are you Protected from the Next Disaster?

How the NFIP Works

How You Can Benefit from the New ICC Endorsement

Myths & Facts

Nothing Could Dampen the Joy of Home Ownership

Preferred Risk Policy

Things You Should Know About Flood Insurance

Tips on Handling Your Flood Insurance Claim

Top 10 Facts Every Consumer Needs to Know About the NFIP

What You Need to Know About Federal Disaster Assistance & National Flood Insurance

Who is at Risk for Flooding?

Why You Should Have a Preferred Risk Policy

Your Homeowners Insurance Doesn't Cover Floods

Flood Zone Determination Companies

National Flood Insurance Program (NFIP) Program Description

***Insurance Professional Publications***

Flood Insurance Manual

Here's What to Tell Your Clients About the Benefits of Flood Insurance

Top 10 Facts Every Agent Needs to Know About the NFIP

Floodplain Management

***Floodplain Management***

Above the Flood: Elevating Your Floodprone House

Addressing Your Community's Flood Problems

After a Flood: The First Steps

Alluvial Fans: Hazards and Management

Answers to Questions About Substantially Damaged Buildings

Answers to Questions About the National Flood Insurance Program

A Report - Mitigation of Flood and Erosion Damage to Residential Buildings in Coastal Areas

A Unified National Program for Floodplain Management

Coastal Construction Manual: Principles and Practices of Planning, Siting,

Designing, Constructing, and Maintaining Residential Buildings in Coastal Areas

Code Capability Report and Appendices A-F

Design Guidelines for Flood Damage Reduction

Engineering Principles and Practices of Retrofitting Floodprone Residential Structures

Elevated Residential Structures

Engineering Principles and Practices of Retrofitting Floodprone Residential Structures

Federal Programs Offering Non-structural Flood Recovery and Floodplain Management

Alternatives

Flood Insurance Program Community Status Book

Floodplain Management Bulletin 1-98 - Use of Flood Insurance Study FIS Data As Available Data

Floodplain Management in the United States: An Assessment Report Summary and Volume 2:

Full Report

Floodproofing Non-Residential Structures

Hazard Mitigation Grant Program Desk Reference

Homeowner's Guide to Retrofitting: Six Ways to Protect Your House from Flooding

Managing Floodplain Development in Approximate Zone A Areas - A Guide for Obtaining and Developing Base (100 yr) Flood Elevations

Manufactured Home Installation in Flood Hazard Areas

National Flood Insurance Program - Community Rating System (CRS) Coordinator's Manual

Protecting Building Utilities from Flood Damage

Protecting Floodplain Resources - A Guidebook for Communities

Protecting Building Utilities from Flood Damage: Principles and Practices for Design and Construction of Flood Resistant Utility Systems.

Property Acquisition Handbook for Local Communities

Repairing Your Flooded Home

Reducing Flood Losses through International Code Series

Reducing Losses in High Risk Flood Hazard Areas: A Guidebook for Local Officials

Report of the Floodplain Management Forum

Technical Bulletins

***State & Local Official Publications***

Federal Programs Offering Non-Structural Flood Recovery and Floodplain Management Alternatives -- 381 KB

Hazard Mitigation Grant Program Desk Reference

Managing Floodplain Development in Approximate Zone A Areas

Managing Floodplain Development through the NFIP, student manual

Property Acquisition Handbook for Local Communities

Reducing Flood Losses through International Code Series

Reducing Risk: Information for Communities

Federal Programs Offering Non-Structural Flood Recovery and Floodplain Management Alternatives -- 381 KB

NFIP Bulletins

NFIP Study Guide

Report of the Floodplain Management Forum

**Dam Safety**

FEMA 64, Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners

FEMA 94, Federal Guidelines for Dam Safety: Selecting and Accommodating Inflow Design Floods for Dams

FEMA 333, Federal Guidelines for Dam Safety: Hazard Potential Classification Systems

for Dams -- 3.77 MB  
Special Workshop On Risk Assessment For Dams -- 79.9 MB  
Issues, Resolutions And Research Needs Related to Embankment Dam Failure Analysis  
-- 8.53 MB  
Report on Specialty Workshop #1: Plant & Animal Impacts On Earthen Dams -- 47.1  
MB  
Association of State Dam Safety Officials (ASDSO)/EPRI Spillway Gate Workshop --  
94.6 MB

### **Floods**

Answers to Questions About Substantially Damaged Buildings -- 380 KB  
Evaluation of Erosion Hazards Report -- 3.97 MB  
Executive Summary of Erosion Hazards Study -- 544 KB  
Floods and Flash Floods (Factsheet and Backgrounder) -- 254 KB  
How To Series: Protecting Your Property From Flooding  
Reducing Flood Losses Through the International Code Series

### **References**

- Holbert, H.S. 1958. Flood Damage at Twin Bridges, Montana. summary of news articles 1874-1957, 2 pp.
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### **Persons and Agencies Contacted**

Preparation of this report included research into the history of flooding in Madison County, the availability of maps reflecting flood prone or flood plain areas in the County, the current FEMA program for flood hazard assessment and flood plain mapping, and contact with the following individuals and agencies:

Ms. Shirley Galovic - Ruby Valley Conservation District  
Ms. Marni Thompson - Natural Resources Conservation Service  
Ms. Doris Fischer - Madison County Planner  
Mr. Allen Armstrong - Gallatin County GIS Dept.  
Ms Kim Miller - Madison County Grants Dept.  
Mr. Ralph Hamler- Madison County Sanitarian  
Ms. Susan Nelson - Office of the Madison County Sanitarian  
Mr. Steve Orr - Chairman, Local Emergency Planning Committee  
Mr. Roger Staley- Former Madison County Planner  
Town of Twin Bridges  
Local Emergency Planning Committee  
Ruby Valley Library in Sheridan

Prepared by:

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October 2003

## **Flood Vulnerability**

Madison County remains vulnerable to flooding. The extent of this vulnerability is difficult to determine accurately due to the lack of reliable data on flood plains. However, as pointed out in flood hazard analysis vulnerable and at risk from the impacts of flooding in Madison County are many private structures, including those associated with residential and commercial development and agriculture operations, and considerable investment in public infrastructure such as roads, bridges, and utilities. Overlays of structures and roads in Madison County are available and can be used in conjunction with the map of areas subject to flooding to identify targets that might be impacted. Facilities at risk and the level of risk can be generally summarized as follows:

Residential structures - high  
Commercial structures - low  
Agricultural structures (buildings, fences, diversions, etc.) - high  
Agricultural cropland - high  
Roads - high

Bridges - high  
Utilities - low

As well, immediate and long-term secondary impacts of flooding to Madison County will be felt in other sectors of the community and its economy. Impacts to irrigation and crop and animal production can be expected as can impacts to outdoor recreation and the economy that depends on it. Public water supplies in and around developed communities are threatened and often impacted by flooding events, including through contamination and the disruption of distribution systems.

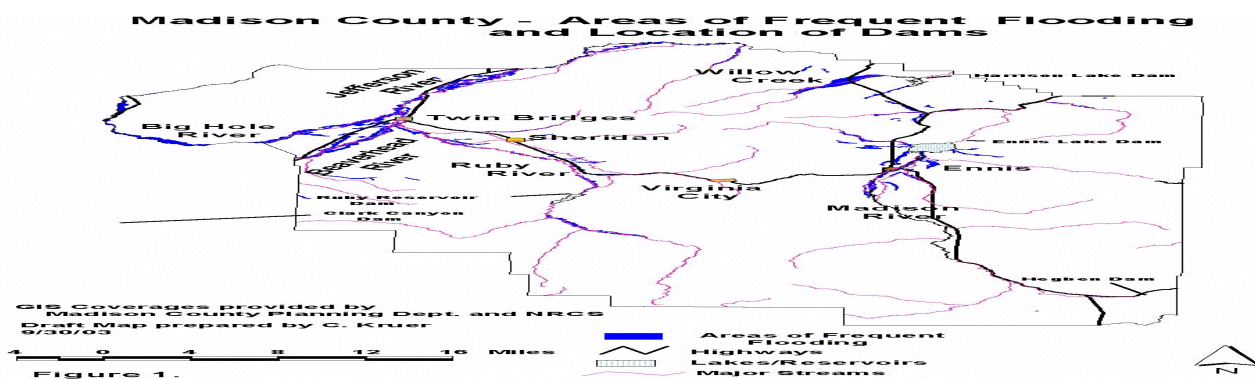
Areas that are particularly vulnerable to flooding are the Waterloo area in the north end of the County, the rural areas around Twin Bridges, rural areas around Ennis, and all areas along the Madison River, Ruby River, Beaverhead River, Big Hole River, and Mill Creek which runs through Sheridan.

### **Community Flooding Vulnerability**

While flooding has occurred in all four of Madison County's Incorporated Towns to some extent, Ennis, Twin Bridges and Sheridan of the incorporated communities are most at risk to this hazard.

Ennis is located on the Madison River. Hebgin Dam and Quake Lake Dam, a natural dam formed by the Hebgin Lake Earthquake in 1959, are located 40 miles upstream. The Madison River gorges in the winter during extended periods of sub-zero temperatures. This changes the course of the river and has diverted the flow into Ennis. When the gorge ice thaws it can again change the course of the river diverting it into yet another direction.

Twin Bridges is located in a lowland area along the Beaverhead River, just downstream of the confluence of the Beaverhead River and the Ruby River and just up stream of the confluence of the Beaverhead River, (now containing the water of the Ruby River) and the Big Hole River. The Beaverhead River and the Big Hole River come together to form the Jefferson River. In highwater years when snowpack melts late or too fast, Twin Bridges experiences flooding. Ice jams also present flooding problems in the early spring.



## **FLOOD DAMAGE AT TWIN BRIDGES, MONTANA**

References: The Madisonian, a weekly newspaper published in Virginia City, Montana  
The Sheridan Enterprise, a weekly newspaper published in Sheridan, Montana  
The Madison County Monitor, a weekly newspaper published in Twin Bridges, Montana

The winter of 1874-75 was extremely cold, with much snow. Feed and straw were short and there were heavy stock losses. May 15, 1875...The water in the Jefferson River was high and the Ruby River was higher than usual.

June 1, 1876...the Ruby River was higher than for several years, and in many places in the Ruby Valley, the bottom land resembled a little sea.

June 8, 1876...The high water of last week washed out the smelter and wheel at Iron Rod. The bridge over Pipestone Creek near Whitehall was carried away. Extra high water in Alder Creek and other creeks. Much snow on peaks and mountains.

June 15, 1876...This is not a good spring for bridges. Many have been washed out and more damaged. The Stinkingwater (Ruby), Beaverhead and Big Hole overflowed their banks. The Territorial Grange, which met in Sheridan, was not fully represented because of high water.

June 11, 1908...Heavy rains through out Montana cause disaster. Heavy rain and snow for 30 days. Heavy damage to crops, bridges out, and all three railroads were tied up due to washouts. City of Butte had power cutoff for one night. There were 8 inches of snow in one night. The farmers residing near Twin Bridges were the heaviest losers in Madison County, with losses of grain crops and live stock.

June 18, 1908...The high water situation in the vicinity of Twin Bridges has not improved during the last week. Recent reports from there are to the effect that the Beaverhead River is higher than it has ever been known to be. Near the Point of Rocks on the Dillon Road the river is out of its banks and covers a stretch of country two miles wide. Low land crops under water for two weeks are ruined.

May 7, 1915...Rained continuously for 48 hours and let down estimated 2 inches. Heavy rains all during May. Rivers out of banks.

June 11, 1915...High water washed away approach to Big Hole bridge and threatened to wash out bridge, but county crews saved it with teams. All roads nearly impassable because of rain.

June 17, 1927...Montana Power Dam as Wise River broke. The resulting high water ran down Bridge Street in Twin Bridges. Yards, basements and houses flooded. The Fair Grounds



were under water. Most ranches between Twin Bridges and Dillon were flooded and under water. The Bird and Balkovetz ranch dwellings near Pennington Bridge were in three feet of water. There were no lives lost.

June 25, 1937...Severe storm June 23rd. High wind and cloudbursts. Roads washed out. Wind blew Tom Novich house three feet off foundation. Eighteen inches of water on roads near Twin Bridges for a time.

Flood damage seems to have been just one of the hazards of life in Montana according to newspapers. Reporting was done by local correspondents, who did not always seem to think that a normal occurrence like high water was newsworthy, unless the water overflowed into the streets or pastures. Old timers tell of when the area from the Beaverhead River west to the Big Hole was all under water nearly every spring. The mail was brought in by a swimming horse.

Even in exceptional flood years, all the newspapers did not report the floods. A cross check between papers for the same year shows that one paper would carry a story while the other would ignore the matter altogether.

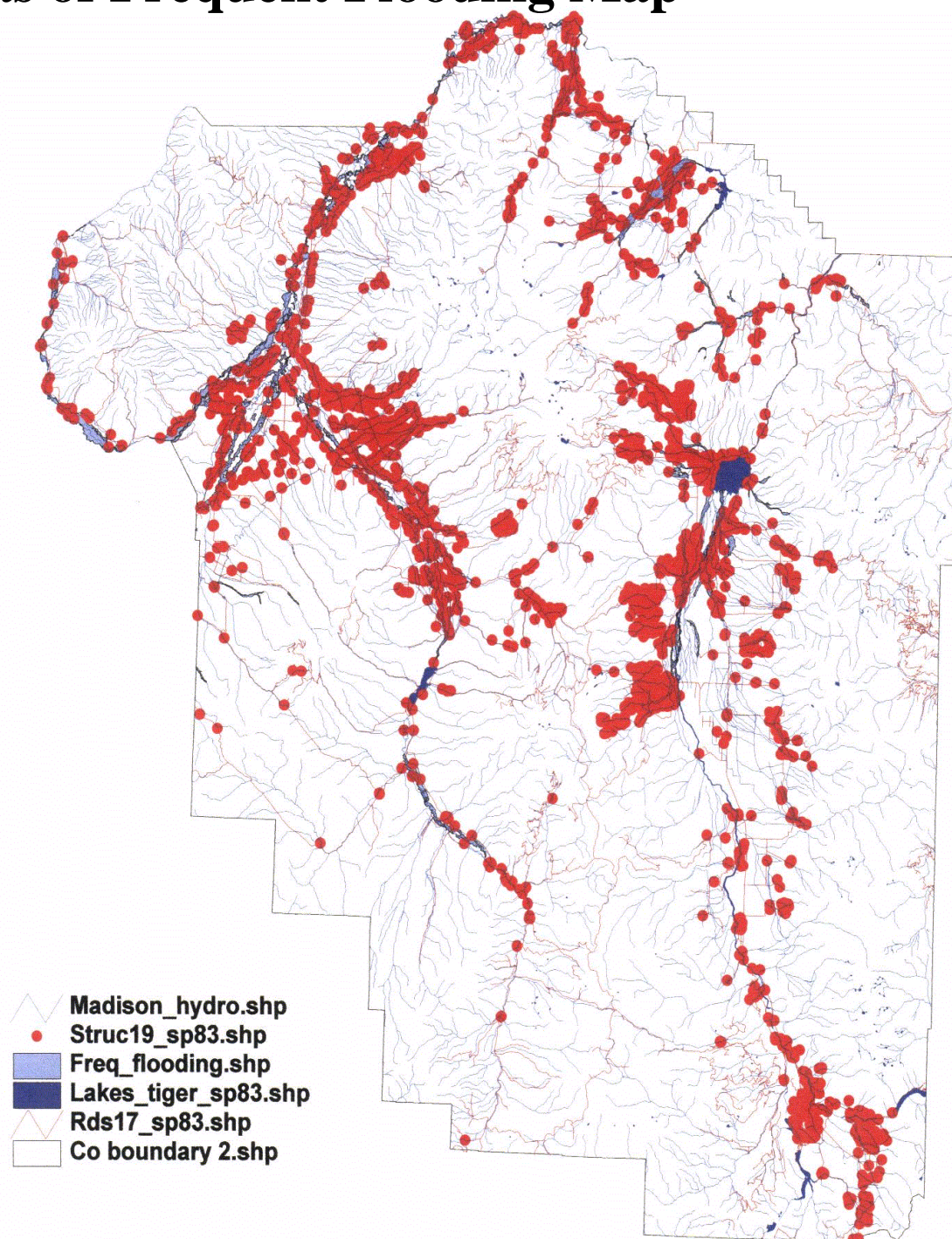
Until the State Highway was built in Twin Bridges, there were two sloughs running through the Town. This permitted overflows from the Beaverhead during high water to run harmlessly away. These sloughs have been filled and houses built on them and during high water or ice jams the river now has no place to go except over its bank, with subsequent flooding of the houses adjoining the river banks.

Spring high water has become less important than formerly. Heavy use for irrigation reduces the flow and the Beaverhead at Twin Bridges becomes very low. However, this year (1958) there have been fairly heavy rains. During these rains the ranchers do not irrigate so the River goes up and during the week of June 18th to 25th the Beaverhead was bank full. If there had been a late spring, with heavy snows in the hills and heavy rains there would have been flooding.

This concludes the information we have been able to compile. Future years with heavy snow and high temperatures in November and December, followed by a quick drop in temperature will probably duplicate the ice jams and floods of 1955 and 1956.

Howard S. Holbert, Mayor - - August 23, 1958

## Madison County Existing Structures and Areas of Frequent Flooding Map



## ASSETS INVENTORY

One of the major components of the risk assessment is to identify those assets that are more vulnerable to the identified hazards. Those facilities that are considered vital to the community such as law enforcement, fire services, health services, and governmental services have been identified as Critical Facilities. Also considered as Critical Facilities are facilities housing particularly vulnerable populations such as hospitals, nursing homes, schools, and the Madison County Jail.

### CRITICAL FACILITIES IN MADISON COUNTY

April 2004

NAME	ADDRESS	Estimated SIZE (sq. ft.)	Estimated REPLACEMENT VALUE	INFORMATION SOURCE(s)
Madison Co. Courthouse	102 W. Wallace Virginia City 59755	12,750	\$1,232,940 – bldg value \$5-10,000,000 – est. replacement value (historic bldg – irreplaceable)	Madison Co. Liability Insurance Report, Homeland Security Office, County Planning Office
Old Virginia City Schoolhouse (Madison Co. & State of MT Offices, plus Virginia City Town Hall)	313 E. Idaho Virginia City 59755	2,024 (office space) 2,024 (storage)	\$ 60,324 – bldg value \$ 500,000 – est. replacement value	Madison Co. Liability Insurance Report, Madison Co. Buildings Evaluation Report, County Planning Office
Madison Co. Offices in 1 <sup>st</sup> American Title Co. Bldg.	106 E. Wallace Virginia City 59755	3,137	\$ 224,000	Building owner
Madison Valley Hospital, Clinic	217 N. Main Ennis 59729	16,000	\$6,000,000	Hospital Administrator, Architect
Ruby Valley Hospital	220 E. Crofoot Sheridan 59749	N/A	N/A	County Planning Office
Ennis Town Hall, Ambulance Service Bldg.	328 W. Main Ennis 59729	7,800	\$ 370,000	MMIA
Ruby Valley Ambulance Service Bldg.	204 E. Crofoot Sheridan 59749	4,000	\$ 400,000	County Planning Office
Alder Fire Hall,	31 Upper Ruby	4,800	\$ 208,000	Alder Fire Chief

MADISON COUNTY PRE-DISASTER MITIGATION PLAN

Community Ctr.	Alder 59710			
NAME	ADDRESS	Estimated SIZE (sq. ft.)	Estimated REPLACEMENT VALUE	INFORMATION SOURCE(s)
Gallatin Canyon Consolidated RFD Station #1	[located at Big Sky in Gallatin County, but also serves Madison County portion of Big Sky]	10,000	\$ 752,456 bldg. \$1,200,000 contents	GCCRFD Fire Chief
Gallatin Canyon Consolidated RFD Station #2	Lone Mountain Trail, Big Sky 59716	4,600	\$ 529,931 bldg. \$1,300,000 contents	GCCRFD Fire Chief
Harrison Fire Hall	Main Street Harrison 59735	2,000	\$ 200,000	County Planning Office
Madison Valley RFD Station #1	5035 USH 287N Cameron 59720	7,285	\$ 525,000	Talbot Insurance Agency
Madison Valley RFD Station #2	1103 USH 287N Ennis 59729	2,280	\$ 150,000	Talbot Insurance Agency
Sheridan Fire Hall, Town Hall	103 E. Hamilton Sheridan 59749	3,500	\$ 350,000	County Planning Office
Twin Bridges Fire Hall, Town Hall	210 N. Main Twin Bridges 59754	6,000	\$ 600,000	County Planning Office
Virginia City Fire Hall	360 E. Wallace Virginia City 59755	3,250	\$ 325,000	Historic Pres. Office, original construction cost, & contractor evaluation
Madison County Airport – Twin Bridges	Airport Road Twin Bridges 59754	Runway and associated facilities	N/A	County Planning Office

MADISON COUNTY PRE-DISASTER MITIGATION PLAN

Madison County Airport – Ennis/Big Sky	Runway Road Ennis 59729	Runway and associated facilities	\$ 2,500,000	Robert Peccia & Associates
Madison Co. Weed Shop	38 Judy Lane Alder 59710	1,594	\$ 23,910	Weed Coordinator, Contractor Estimate
Big Sky Sewer & Water District [hdqtrs at Big Sky in Gallatin County, but also serves Madison County portion of Big Sky]	Office, 561 Little Coyote Rd	2,530	\$ 400,000	General Manager
	Maint. Shop, 575 Little Coyote Rd.	2,725	\$ 150,000	
	Treatment Plant, 567 Little Coyote Rd Big Sky 59716	.6MGD (design capacity)	\$14,000,000	

## VULNERABLE POPULATIONS and OTHER COMMUNITY FACILITIES

**April 2004**

NAME	ADDRESS	Estimated SIZE (sq. ft.)	Estimated REPLACEMENT VALUE	INFORMATION SOURCE(s)
Madison Valley Manor -- County nursing home	211 N. Main Ennis 59729	N/A	\$1,486,394 bldg. \$ 170,000 contents	Madison Co. Liability Insurance Report, Talbot Insurance Agency
Tobacco Root Mtn. Care Center – County nursing home	326 Madison Sheridan 59749	N/A	\$ 1,054,470 bldg. \$ 134,000 contents	Madison Co. Liability Insurance Report, Talbot Insurance Agency
Alder Elementary School	40 Upper Ruby Rd Alder 59710	5,000 (two bldgs)	\$ 500,000	County Planning Office
Ennis Schools	Elementary, 101 Charles St	37,780	\$3,206,000	Western States Insurance
	H.S., 223 Charles St	39,797	\$5,055,900	
	Vo-Tech, 306 Charles St	3,200	\$ 189,400	
	Bus Barn, 60	7,700	\$ 283,700	

MADISON COUNTY PRE-DISASTER MITIGATION PLAN

	Mtn View Ennis 59729			
Harrison Schools	7540 USH 287N Harrison 59735	37,876	\$3,801,000	Western States Insurance – Helena
NAME	ADDRESS	Estimated SIZE (sq. ft.)	Estimated REPLACEMENT VALUE	INFORMATION SOURCE(s)
Sheridan Schools	Elem., 211 Madison	37,128	\$2,869,709	School District Clerk, General Fixed Asset Inventory
	H.S., 107 Madison	33,380	\$1,600,000	
	Charles B. Murray bldg., 105 Madison	13,991	\$ 735,000	
	Bus barn & music bldg., 307 E. Poppleton	1,944	\$ 226,500	
	Vo-Ag, 107 ½ Madison Sheridan 59749	3,200	\$ 52,000	
Twin Bridges Schools	216 W. Sixth Twin Bridges 59754	91,400	\$9,420,000	School personnel, Spectrum Architecture
Madison Co. Museum & Thompson- Hickman Library	217 E. Idaho Virginia City 59755	1,440	\$ 176,719 bldg. \$ 20,000 contents (historic bldg – irreplaceable)	Madison Co. Liability Insurance Report
Sheridan Sr. Citizens Center	106 W. Hamilton Sheridan 59749	1,400	\$ 63,000	Talbot Insurance Agency
Pony Sr. Citizens Center (Masonic Lodge bldg)	200 Broadway Pony 59747	4,000	\$ 600,000	Building owner

MADISON COUNTY PRE-DISASTER MITIGATION PLAN

NAME	ADDRESS	Estimated SIZE (sq. ft.)	REPLACEMENT VALUE	INFORMATION SOURCE(s)
Madison County Fairgrounds	Fairgrounds Loop Twin Bridges 59754	Log cabin – 650  Octagonal bldg – 7,100  Frame exhibit bldg – 3,635  2 metal exhibit bldgs – 4,200  Grandstands	\$ 22,399  \$ 414,484  \$ 35,573  \$ 51,517 (some historic bldgs – irreplaceable)  N/A	Madison County Liability Insurance Report, Talbot Insurance Agency, Madison Co. Buildings Evaluation Rept.
Alder Post Office	2325 MT Hwy 287 Alder 59710	600	\$ 60,000	Building owner, County Planning Office
Cameron Post Office	3795 USH 287N Cameron 59720	2,923	\$ 292,300	Postmaster, County Planning Office
Ennis Post Office	81 MT Hwy 287 Ennis 59729	3,941	\$ 500,000	Facility Security Survey, USPS
Harrison Post Office	Main Street Harrison 59735	600	\$ 60,000	County Planning Office
McAllister Post Office	5549 USH 287N McAllister 59740	1,200	\$ 120,000	County Planning Office
Norris Post Office	6536 USH 287N Norris 59745	225	\$ 20,500	Farmers Union Insurance & building owner
Pony Post Office	3 S. Reel St. Pony 59747	850	\$ 67,000	Postmaster
Sheridan Post Office	208 S. Main Sheridan 59749	1,884	\$ 89-90,000	Safeco and Postmaster
Silver Star Post Office (part of building)	5342 Hwy 41 Silver Star 59751	800	\$ 185,000 (whole building)	Farm Bureau Financial Services
Twin Bridges Post Office	101 S. Main Twin Bridges	2,622	\$ 262,200	Postmaster

MADISON COUNTY PRE-DISASTER MITIGATION PLAN

	59754			
NAME	ADDRESS	Estimated SIZE (sq. ft.)	REPLACEMENT VALUE	INFORMATION SOURCE(s)
Virginia City Post Office (part of bldg)	209 W. Wallace Virginia City 59755	1,800	\$ 360,000 (historic bldg – irreplaceable)	County Planning Office
US Forest Service District Office	5 Forest Service Road Ennis 59729	5,000	\$ 500,000	County Planning Office
US Forest Service Work Center	W. Crofoot & Main Street Sheridan 59749	3,500	\$ 350,000	County Planning Office
Madison Valley Public Library	210 E. Main Ennis 59729	1,400	\$ 140,000	County Planning Office
Sheridan Public Library	109 E. Hamilton Sheridan 59749	2,000	\$ 200,000	County Planning Office
Twin Bridges Public Library	206 S. Main Twin Bridges 59754	1,700	\$ 170,000	County Planning Office
Ennis Community Children's School	315 Steffens Ennis 59729	1,400	\$ 100,000	School director, Building owner
2 <sup>nd</sup> Ennis Preschool	419 W. Steffens Ennis 59729	3,840	\$ 140,000	Building owner, Kamp Appraisal
Ready-Set-Grow Preschool (part of church bldg)	211½ S. Main Sheridan 59749	600	\$ 80,000	County Planning Office
Kid Country Learning Center	314 Main St. Twin Bridges 59754	1,256	\$ 95,000 bldg \$ 20,000 contents	Building owner
Madison Meadows Golf Course	110 Golf Course Drive Ennis 59729	Golf pro shop – 1,690 Metal shop – 2,400	\$ 85,843 \$ 121,840	Madison County Liability Insurance Report, Talbot Insurance Agency

In addition to critical facilities, residences, businesses, and the citizens on Madison County are also vulnerable to the identified hazards. According to the U.S. Census Bureau data for the 2000 Census,



Madison County had a population of 6,851. Madison County has a total of 4,671 housing units with a median value of \$104,500 according to the U.S. Census Bureau. Using the median value of \$104,500 per housing unit, times the 4,671 housing units in Madison County, the total value of residential structures can be estimated at \$488,119,500. The *Madison County Housing Census Data For 2000* table below provides a breakdown of those housing units.

<b>Madison County Housing Census Data For 2000</b>	
<b>Housing Units in Structure</b>	<b>Number</b>
1-unit, detached	3,227
1-unit, attached	178
2 units	86
3 or 4 units	112
5 to 9 units	146
10 to 19 units	141
20 or more units	92
Mobile home	672
Boat, RV, van, etc	17
<b>TOTAL HOUSING UNITS</b>	<b>4,671</b>
<b>Year Structure Built</b>	<b>Number</b>
1999 to March 2000	181
1995 to 1998	606
1990 to 1994	558
1980 to 1989	672
1970 to 1979	916
1960 to 1969	325
1940 to 1959	490
1939 or earlier	923
<b>Housing Value</b>	<b>Number</b>

<b>Madison County Housing Census Data For 2000</b>	
Less than \$50,000	95
\$50,000 to \$99,999	411
\$100,000 to \$149,999	294
\$150,000 to \$199,999	129
\$200,000 to \$299,999	81
\$300,000 to \$499,999	59
\$500,000 to \$999,999	2
\$1,000,000 or more	0
<b>Median (dollars)</b>	<b>\$104,500</b>

## Development Trends

The population grew over 16% between 1990 and 2000. Most of that increase is in the 35+ age class that corresponds with many adults with established incomes looking for a rural setting to live in, at least on a part time basis. This is supported by the fact that the vacancy rate on existing housing dropped from 39% in 1990 to less than 5% in 1998.

Most of this growth has been in the Madison Valley, followed closely by the Ruby Valley around Sheridan and Twin Bridges. The north end of the County, which is just across that County Line from Whitehall, is also experiencing a great deal of growth.

# MITIGATION STRATEGIES

The Madison County Local Emergency Planning Committee has closely monitored the development of the Madison County Pre-Disaster Mitigation Plan and analyzed the risk assessment studies. The mitigation strategies were developed based on input from the communities in Public Meetings, and LEPC Meetings, focusing on the priorities set by the citizens of Madison County.

Initial mitigation goals and objectives were reviewed by the public and refined in public meetings in which suggestions from the attendees were incorporated. As a result of this input and prioritizations, the Local Emergency Planning Committee has developed a set of goals that were determined to have the greatest benefit for the citizens of the County. These strategies took in to account recommendations in existing policies, plans, and studies. The goals, objectives, and actions are as follows:

**Goal 1: Have someone designated to provide leadership and coordination for disaster mitigation efforts and response in Madison County, and monitor progress of mitigation efforts. Institute a more proactive DES Program.**

**Objective 1.1:** Make Disaster and Emergency Services Coordinator a full-time position by July 1, 2004.

**Action 1.1.1:** Develop a scope of work.

Time frame: 6 months

Funding: None needed

Staff: LEPC

**Action 1.1.2:** Explore supportive funding sources

Time frame: 6 months

Funding: None needed

Staff: Madison County Grant Writer

**Action 1.1.3:** Approach County Commissioners with scope of work, needed funding, & available resources.

Time frame: 90 days

Funding: None needed

Staff: LEPC

**Goal 2:        Reduce loss of life, injuries and property damage in the event of a earthquake.**

**Objective 2.1:**        Educate the populace of proactive measures regarding earthquake safety.

**Action 2.1.1:** Produce earthquake educational brochures to be distributed by the Madison County Sanitarian, The Madison County Planner, Town Halls, Realtors, etc.

Time frame:    1 year

Funding:        FEMA / DES funding

Staff:            College Intern overseen by DES Coordinator

**Action 2.1.2:** Continued geologic review of proposed sub-divisions.

Time frame:    On going

Funding:        No additional needed

Staff:            Planning Office

**Action 2.1.3:** Initiate geologic review of existing subdivisions for educational purposes.

Time frame:    1 year

Funding:        FEMA / DES Funding

Staff:            Contractor overseen by DES Coordinator

**Action 2.1.4:** Educate new home builders as to seismic building standards and earthquake fault locations.

Time frame:    1 year

Funding:        FEMA / DES

Staff:            DES Coordinator, working with Southwest Montana Homebuilders Association

**Objective 2.2:**Educate the Public Sector as to Earthquake mitigation measures.**Action 2.2.1:** Assist in updating earthquake plans for public entities.

Time frame: On going

Funding: State &amp; Federal Grants

Staff: Entity's administering body &amp; LEPC

**Action 2.2.2:** Assist in identifying and make recommendations in retro fitting unsafe public buildings with mitigation efforts.

Time frame: On going

Funding: State &amp; Federal Grants, Low Interest Loans

Staff: Contractor

**Action 2.2.3:** Prioritize most vulnerable infrastructure.

Time frame: 1 year

Funding: State &amp; Federal grants, Low interest loans

Staff: Contractor

**Action 2.2.4:** Develop cost estimates of bringing infrastructure to seismic code.

Time frame: 6 months

Funding: No additional needed

Staff: Contractor working with Entity's administering body

**Action 2.2.5:** Make improvements identified to bring infrastructure up to seismic code.

Time frame: On going

Funding: Grants

Staff: Entity's administering body

**Action 2.2.6:** Assure all future infrastructure is earthquake resistant and built to

seismic code.

Time frame: On going

Funding: No additional needed

Staff: Entity's administering body

**Goal 3: Reduce loss of life and prevent injury in the event of a Hazardous Materials incident.**

**Objective 3.1:** Undertake a program of public education and awareness of Hazardous Materials.

**Action 3.1.1:** Determine type and amount of Hazardous Materials moving through Madison County

Time frame: 1 year

Funding: EPA / DOT grants

Staff: College Intern overseen by DES Coordinator

**Action 3.1.2:** Develop, produce and distribute Hazmat educational publications

Time frame: 1 year

Funding: FEMA, EPA, / DOT grants

Staff: College Intern overseen by DES Coordinator

**Action 3.1.3:** Develop an early warning system to alert affected populations of a Hazmat incident.

Time frame: 2 years

Funding: FEMA / DES Funding

Staff: DES Coordinator

**Objective 3.2:** Train Emergency Response Personnel for Hazmat Response.

**Action 3.2.1:** Train Emergency Personnel to at least awareness level.

Time frame: 1 to 2 years

Funding: ODP / FEMA / DOT grants

Staff: DES Coordinator & State Fire Training School

**Action 3.2.2:** Develop response procedures for all emergency organizations.

Time frame: 2 years

Funding: No additional needed

Staff: Emergency Response Organization Administrators, DES Coordinator and LEPC

**Action 3.2.3:** Equip Emergency Personnel commensurate with training level.

Time frame: 2 years

Funding: ODP / EPA / EPA / DOT / Organization budgets

Staff: Emergency Response Organization Administrators, DES Coordinator and LEPC

**Objective 3.3:** Lessen exposure to Hazmat incident.**Action 3.3.1:** Reroute Hazardous Material traffic through out of Madison County.

Time frame: 1 year

Funding: No additional needed

Staff: DES Coordinator, County Commissioners, and LEPC working with the Montana Department of Transportation.

**Goal 4: Sustain Economic Viability in the event of a Hazardous Material incident.****Objective 4.1:** Develop and implement procedure for timely recovery.

**Action 4.1.1:** Appoint an oversight system for recovery

Time frame: 1 year

Funding: No additional needed

Staff: DES Coordinator

**Action 4.1.2:** Identification of procedures for recovery mitigation

Time frame: 1 year

Funding: No additional needed

Staff: DES Coordinator

**Objective 4.2:** Foster interagency cooperation to ensure effective implementation of Hazmat mitigation and response efforts.

**Action 4.2.1:** Develop County-wide Hazmat incident response plan.

Time frame: 2 years

Funding: FEMA / DES Funding

Staff: DES Coordinator, LEPC, Local, County, State and Federal Agencies.

**Action 4.2.2:** Assure that all required mutual aid agreements are in place.

Time frame: 2 years

Funding: No additional needed

Staff: DES Coordinator

**Goal 5: Expedite Environmental Recovery in the event of a Hazardous Material incident.**

**Objective 5.1:** Insure that procedures are in place for a quick response to and a timely clean up of a Hazardous Material incident.

**Action 5.1.1:** Develop plan for the activation of required assets to respond quickly to contain and clean up a Hazardous Material spill.



Time frame: 1 year

Funding: No additional needed

Staff: DES Coordinator

**Goal 6: Develop Public Health capacity to identify and respond to a bio-terrorism event**

**Objective 6.1:** Hire a full time Public Health Officer

**Action 6.1.1:** Develop a scope of work

Time frame: 1 month

Funding: none needed

Staff: Contractor

**Action 6.1.2:** Draw down state funding for local PHO

Time frame: immediate

Funding: none needed

Staff: PHN

**Action 6.1.3:** Approach County Commissioners with scope of work, funding source and identified candidates

Time frame: immediate

Funding: none needed

Staff: PHN, LEPC

**Objective 6.2:** Implement active surveillance system

**Action 6.2.1:** Develop data base of providers with ability to track weekly reports

Time frame: 3 months

Funding: BT grant

Staff: PHO/PHN

**Action 6.2.2:** Educate providers on tracking and reporting signs and symptoms of biological agents

Time frame: 6 months

Funding: none needed

Staff: PHO/PHN

**Action 6.2.3:** Assure functionality of Health Alert Network

Time frame: 3 months

Funding: Bio-terrorism grant

Staff: PHO

**Action 6.2.4:** Develop MOU's with health care providers and institutions

Time frame: 6 months

Funding: none

Staff: PHO

**Objective 6.3:** Coordinate an effective response system through improved communications

Time frame: 1 year

Funding: grants , explore public/private partnerships

Staff: LEPC, PHO

**Goal 7: Reduce or prevent loss of life and injuries and property damage in the event of flooding.**

**Objective 7.1:** Conduct a floodplain (100-year flood) mapping project for Madison County consistent with FEMA mapping protocol.

**Action 7.1.1:** Identify potential funding sources and develop a scope of work.

**Action 7.1.2:** Obtain funding and implement project.

**Action 7.1.3:** Incorporate maps in decision making process.

**Objective 7.2:** Using floodplain maps, maps of current conditions, and all available historical information identify and assess targets at risk including dams.

**Action 7.2.1:** Identify potential funding sources and develop a scope of work.

**Action 7.2.2:** Obtain funding and implement project.

**Action 7.2.3:** Report findings.

**Objective 7.3:** Identify possible hazard mitigation efforts for targets at risk including floodplain buy-outs, floodplain conservation easements, zoning to limit building and rebuilding in high-hazard areas, acquisition and/or relocation, and hardening, strengthening, or elevating structures at risk.

**Action 7.3.1:** Identify potential funding sources and develop a scope of work.

**Action 7.3.2:** Obtain funding and implement project.

**Action 7.3.3:** Finalize review and assess options for effecting mitigation.

**Objective 7.4:** With data and information available from Objective 7.1, 7.2, and 7.3, conduct a cost-benefit analysis to assess the value of mitigation actions.

**Objective 7.5:** Educate the public to the flood hazard and to potential mitigation strategies.

**Goal 8: Wildfire mitigation goals are discussed in Appendix 1**

### Implementation Strategy

As funding or opportunities to initiate these projects becomes available, they can be prioritized with more detailed costs, benefits, and other necessary criteria. Some activities will be targeted to Madison County and/or one or more of the incorporated towns. The implementation strategies for the higher priority projects are set out in the following table.

Implementation Strategy for Projects in Madison County				
Project Description	Jurisdiction	Responsible Agency	Potential Funding Source(s)	Event Priority
Produce earthquake educational brochures to Educate the populace of proactive measures regarding earthquake safety and mitigation	Madison County	Madison County LEPC, Madison County DES	FEMA DES	1
Continued geologic review of proposed sub-divisions	Madison County	Madison County Planning Office, Madison County Commission	Internal	1
Initiate geologic review of existing subdivisions for educational purposes	Madison County	Madison County DES	FEMA DES	1
Educate new home builders as to	Madison County	Madison County DES, Town of	FEMA	1

seismic building standards and earthquake fault locations	Ennis Sheridan Twin Bridges Virginia City	Ennis, Town of Sheridan, Town of Twin Bridges, Town of Virginia City	DES	
Educate the Public Sector as to Earthquake mitigation measures and assist in updating earthquake plans for public entities	Madison County Ennis Sheridan Twin Bridges Virginia City	Madison County LEPC, Madison County DES, Town of Ennis, Town of Sheridan, Town of Twin Bridges, Town of Virginia City	State & Federal Grants	1
Assist in identifying and make recommendations in retro fitting unsafe public buildings with mitigation efforts	Madison County Ennis Sheridan Twin Bridges Virginia City	Madison County LEPC, Madison County DES, Town of Ennis, Town of Sheridan, Town of Twin Bridges, Town of Virginia City	State & Federal Grants Low Interest Loans	1
Prioritize most vulnerable infrastructure	Madison County Ennis Sheridan Twin Bridges Virginia City	Madison County LEPC, Madison County DES, Town of Ennis, Town of Sheridan, Town of Twin Bridges, Town of Virginia City	State & Federal Grants Low Interest Loans	1
Develop cost estimates to bring infrastructure to seismic code and make those identified improvements	Madison County Ennis Sheridan Twin Bridges Virginia City	Madison County LEPC, Madison County DES, Town of Ennis, Town of Sheridan, Town of Twin Bridges, Town of Virginia City	State & Federal Grants	1
Assure all future infrastructure is earthquake resistant and built to seismic code	Madison County Ennis Sheridan Twin Bridges Virginia City	Madison County LEPC, Madison County DES, Town of Ennis, Town of Sheridan, Town of Twin Bridges, Town of Virginia City	Internal	1
Conduct survey to determine type and amount of Hazardous Materials moving through Madison County	Madison County Ennis Sheridan Twin Bridges Virginia City	Madison County LEPC, Madison County DES,	EPA / DOT grants	2
Develop, produce and distribute Hazardous Materials educational publications	Madison County	Madison County LEPC, Madison County DES,	FEMA EPA / DOT grants	2
Develop early warning system to alert affected populations of a Hazardous Materials incident	Madison County	Madison County LEPC, Madison County DES,	FEMA DES	2
Train 80% of all responders to Hazmat Awareness level and 20 % of all responders to Hazmat Operations level	Madison County Ennis Sheridan Twin Bridges Virginia City	Madison County LEPC, Madison County DES, Town of Ennis, Town of Sheridan, Town of Twin Bridges, Town of Virginia City, Harrison FD, Alder FD, Madison Valley Rural FD	ODP FEMA DOT	2
Develop Hazmat response procedures for all emergency	Madison County Ennis Sheridan	Madison County LEPC, Madison County DES, Town of Ennis, Town of Sheridan,	Internal	2

organizations	Twin Bridges Virginia City	Town of Twin Bridges, Town of Virginia City, Harrison FD, Alder FD, Madison Valley Rural FD		
Develop & implement procedure for timely recovery in the event of a Hazmat incident	Madison County Ennis Sheridan Twin Bridges Virginia City	Madison County LEPC, Madison County DES, Town of Ennis, Town of Sheridan, Town of Twin Bridges, Town of Virginia City	Internal	2
Develop County-wide Hazmat incident response plan and assure that all required mutual aid agreements are in place	Madison County Ennis Sheridan Twin Bridges Virginia City	Madison County LEPC, Madison County DES, Town of Ennis, Town of Sheridan, Town of Twin Bridges, Town of Virginia City, Harrison FD, Alder FD, Madison Valley Rural FD	FEMA DES Internal	2
Insure that procedures are in place for a quick response to and a timely clean up of a Hazmat incident	Madison County Ennis Sheridan Twin Bridges Virginia City	Madison County DES	Internal	2
Hire full time Public Health Officer	Madison County Ennis Sheridan Twin Bridges Virginia City	Madison County Public Health Department, Madison County LEPC, Madison County Commission	DPHHS ODP Internal	3
Implement active surveillance system.	Madison County	Madison County Public Health Department	DPHHS Bio-Terrorism grants	3
Develop data base of providers with ability to track weekly reports and educate providers on tracking and reporting signs and symptoms of biological agents	Madison County	Madison County Public Health Department	DPHHS Bio-Terrorism grants	3
Assure functionality of Health Alert Network	Madison County	Madison County Public Health Department	DPHHS Bio-Terrorism grants	3
Conduct a floodplain mapping project for Madison County, Town of Ennis, Town of Sheridan, and the Town of Twin Bridges, consistent with FEMA mapping protocol	Madison County Ennis Twin Bridges Sheridan	Madison County LEPC, Madison County DES, Town of Ennis, Town of Sheridan, Town of Twin Bridges	FEMA DES Internal	4
Using floodplain maps, maps of current conditions, and all available historical information Identify possible hazard mitigation efforts for targets at risk including floodplain buy-outs, floodplain conservation easements, zoning to limit building and rebuilding in high-hazard areas, acquisition and/or relocation, and hardening,	Madison County Ennis Twin Bridges Sheridan	Madison County LEPC, Madison County DES, Town of Ennis, Town of Sheridan, Town of Twin Bridges	FEMA DES Internal	4

strengthening, or elevating structures at risk				
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# PLAN MAINTENANCE PROCEDURES

The LEPC will review and update the Pre-Disaster Mitigation Plan annually. The LEPC is the most logical vehicle for the plan review as it consists of representatives from the Town of Ennis, the Town of Sheridan, the Town of Twin Bridges, the Town of Virginia City, the Madison County Commission, the Planning Office, Madison County Disaster and Emergency Services, local Fire Departments, the Madison County Sheriff's Office, Department of Public Works, Public Health, and Emergency Medical Services. The review meeting will be conducted at the LEPC's January meeting.

The LEPC will review the goals and objectives to determine that the goals for which funding exists are proceeding as planned. The LEPC will review any new risk assessments and modify the plan as indicated by the emergence of new vulnerabilities. Review of ongoing projects will be conducted to determine their status, their practicality, and which project and strategies should be revised.

Once the review has been finalized, the PDM will be updated as needed and then submitted to the State Hazard Mitigation Officer.

This plan is intended to work in conjunction with existing County and Town comprehensive plans. County review and approval of future subdivision applications will be guided by the mitigation strategies set forth in this plan. Similarly, Town governments will be guided by the PDM in making their land use decisions.

Copies of the plan will be available at all of the libraries in the County, The County Commissioner's Office, The Planning Office, The Sanitarian's Office, Meadow Village Fire Station at Big Sky, and at the City Hall in Ennis, Sheridan, Twin Bridges, and Virginia City. The public will be encouraged to make comments and express any concerns that they have with the plan as well as provide ideas they have to improve the plan. Public input into the planning process will be received by the Madison County Commissioner's Office and forwarded to the LEPC.

After the annual review meeting by the LEPC, which is a public meeting, notification of any updates will be published in the local newspaper. All public comments on the proposed updates will be invited at the LEPC's next meeting following the annual review meeting.